City of Nashua, New Hampshire

Nashua WWTF Dewatering and Grit System Upgrades

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Engineering a Better Environment

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Presentation Overview

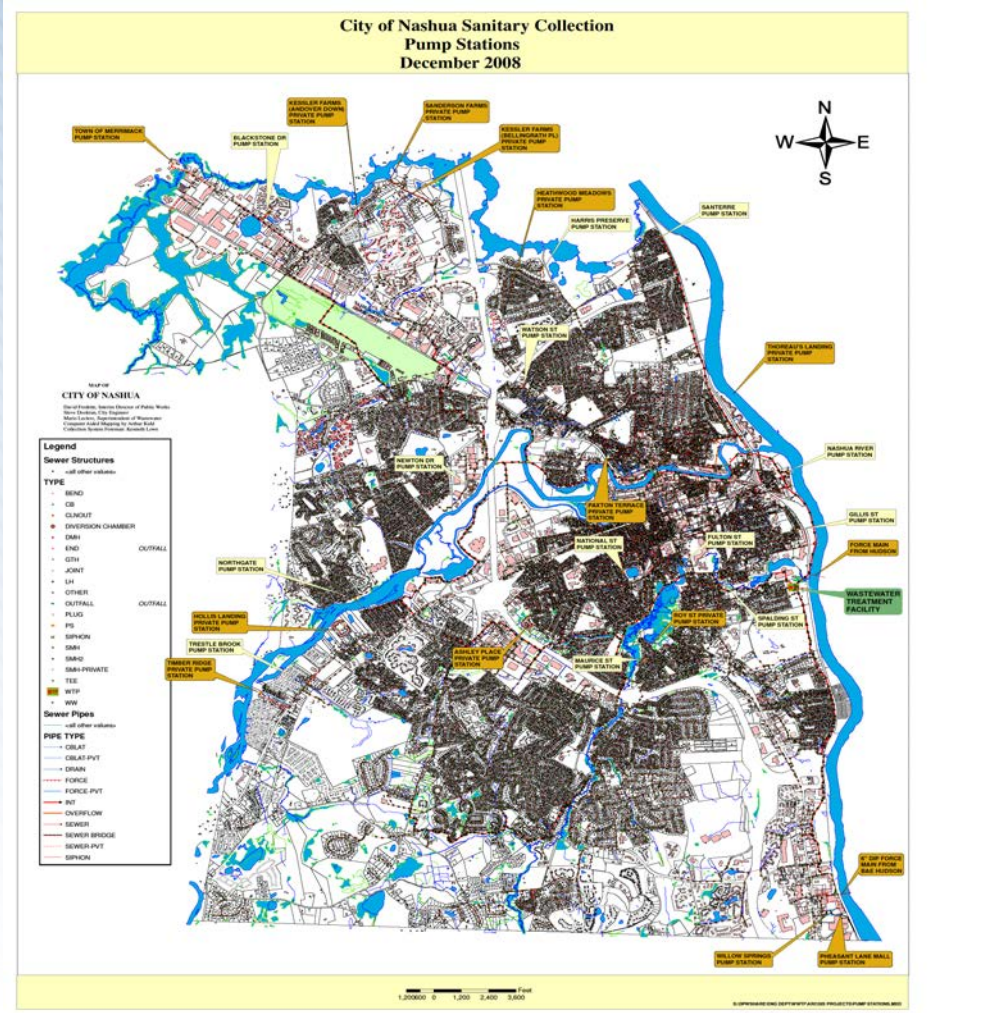
- Nashua WWTF Background
- Project Overview
- Dewatering System
- Grit System
- Secondary Digester
- Odor Control
- Project Challenges
- Recent Improvements

Nashua WWTF Background

- Population
  - 1965 - 40,000
  - 2015 - 90,000
- Main WWTF
  - Average Daily Flow 12.5 MGD
  - Peak Hourly Flow 52 MGD
- Wet Weather Facility
  - Actiflo System
  - Activates 10-14 times per year
  - Peak Hourly Flow 60 MGD
- Effluent Disposal
  - Merrimack River

Nashua WWTF Background

- Collection System
  - Total - 420 miles
    - Combined - 100 miles
    - Separate Sanitary - 190 miles
    - Separate Storm - 130 miles
  - 13 Pump Stations
  - CSO Structures
    - Nashua River - 4
    - Merrimack River - 4
- Service Area
  - Nashua, NH
  - Hudson, NH
  - Merrimack, NH
  - Tyngsboro, MA



Nashua WWTF Background

- 1959 Primary Plant Constructed
- 1974 Collection System and WWTF Expansion
- 1989 Secondary Treatment Upgrade
- 1998 Digester Complex
- 1999 Headworks Renovation
- 2009 Wet Weather Facility

Nashua WWTF Background

Nashua WWTF - 1965

Nashua WWTF Background

Nashua WWTF - 2002

Project Overview

- Project Cost
  - Total Construction Cost $5.8 M
  - Total Engineering Cost $1.0 M
  - Total Project Cost $6.8 M

- Project Schedule
  - Notice to Proceed June 18, 2013
  - Substantial Completion March 6, 2015
  - Final Completion April 5,

Project Overview

Solid Quantities - Basis of Design

	Raw (lb/ day)	Digested (lb/day)	Digested (lb/hr)	Digested % Solids
Average	22,000	12,100	504	2.3
Maximum Month	31,500	17,300	721	2.9
Peak 7-Day	39,900	22,000	914	3.3

Project Overview

- Design Criteria
  - Operation 108 hrs/wk
- Sludge Loading Rate
  - Average 784 lb/hr
  - Max Month 1,122 lb/hr
  - Peak week 1,421 lb/hr
- Huber Q-800
  - Number of Units 3
    - Operating 2
    - Standby 1

Project Overview

Performance Requirements

	Sludge Type	Solids Loading (lbs/hr)	Feed Conc. (% ODS)	Feed Rate (gpm)	VSS (%)	Max Polymer (lbs/dt)	Dewatered Cake Conc. (% ODS)
1	Anaerobic Dig	600	2.4	50	58	25	30
2	Anaerobic Dig	900	2.4	75	58	25	27
3	Anaerobic Dig	600	2.4	50	63	25	24
4	Anaerobic Dig	900	2.4	75	63	25	22
5	Raw Pri/Sec	1050	4.0	52	63	20	22

Project Overview

Biosolids Disposal Cost Savings

	Cake Solids (%)	Annual Dry Solids (tons)	Annual Wet Solids (tons)	Biosolids Disposal ($/wet ton)	Annual Cost ($)	Annual Savings ($)[a]
2007-2009 Avg	21.5	2,052	9,544	$49	$467,665	---
1% Better	22.5	2,052	9,120	$49	$446,880	$20,785
2% Better	23.5	2,052	8,732	$49	$427,864	$39,801
3% Better	24.5	2,052	8,376	$49	$410,400	$57,265
4% Better	25.5	2,052	8,047	$49	$394,306	$73,359
5% Better	26.5	2,052	7,743	$49	$379,426	$88,239
6% Better	27.5	2,052	7,462	$49	$365,629	$102,036
7% Better	28.5	2,052	7,200	$49	$352,800	$114,865
8% Better	29.5	2,052	6,956	$49	$340,841	$126,824
9% Better	30.5	2,052	6,728	$49	$329,666	$138,465

Note: a. Savings are relative to the existing baseline conditions defined in the 2006-2007 average.

Dewatering System

- Old Dewatering Equipment
  - Three Belt Filter Presses (1 Meter Pressure Zone)
    - unpleasant working atmosphere
    - labor intensive maintenance
    - limited performance - average cake solids 21.5%
    - end of useful life

Dewatering System

- New Dewatering Equipment
  - Three Huber Technologies Q-800 Screw Presses
    - enclosed operation
    - low maintenance required
    - enhanced performance - average cake solids up to 30%
    - stainless steel construction is “built to last”

Dewatering System

- Dewatering Equipment
  - Sludge Dewatering Pumps

Old Plunger Pump

New Rotary Lobe Pump

Dewatering System

- Dewatering Equipment
  - Conveyors

Old Belt Conveyors

New Shaftless Screw Conveyors

Grit System

Old Grit Equipment

- Poor grit removal
  - constant speed blowers
  - high aeration rate
    - 388 cfm/tank = 10/cfm/lf
- Equipment failure common
  - troublesome sump
  - clogging of cyclone
    - batch operation
    - labor oversight

Grit System

- New Grit Equipment
  - New variable speed blowers
    - 38 – 190 cfm/tank
    - 1 - 5 cfm/lf
  - New grit chamber screws and pumps
    - eliminated sump
    - cleanouts
    - flushing connections
  - Two Huber grit washers
    - automated operation
    - no clogging
    - 95% organic removal

Secondary Digester

- no mixing
- non-organic material (rags, plastics & grit) build-up
- average solids content 2.4%

Secondary Digester

- New Secondary Digester Mixing Equipment
  - Rotamix - 2 Vaughn Chopper Pumps & 4 Nozzles
    - complete tank mixing
    - non-organic material passed
    - average solids content 1.7%

Odor Control

- Old Odor Control System
  - Building Scrubber
    - recirculation pumps at the end of useful life
    - single speed axial fan
    - unbalanced air flow rates
  - Sludge Storage Tank Scrubbers
    - recirculation pumps at the end of useful life
    - fan improperly sized
    - non-ease of maintenance

Odor Control

- New Odor Control System
  - Building Scrubber
    - new recirculation pumps
    - new floor mounted, radial vane fan on VFD
    - air flows reduced
  - Sludge Storage Tank Scrubbers
    - new recirculation pumps
    - appropriate sized fan
    - new layout
    - ease of maintenance

Project Challenges

- Huber Screw Presses
  - Iron Oxide precipitate on screen
    - Water Treatment Plant is the source of iron
    - iron re-solubilizes in the primary digester
    - dewatering process creates ideal conditions for precipitation (pH of 7 to 9)
  - Solutions
    - mixing in the secondary digester
    - mixing in the sludge storage tanks
    - routine mild acid cleaning of screen

Project Challenges

- Huber Screw Press / Sludge Feed Pumps
  - Premature wearing of brushes / wear plates
    - caused by high grit concentration in the sludge
      - City of Nashua is a combined system
      - Nashua WWTF grit collection off line prior to upgrade
      - Long term poor performance overall

Project Challenges

- Huber Screw Press / Sludge Feed Pumps
  - Solutions
    - new grit facility is online
    - accumulated grit purged from secondary digester
    - secondary digester mixing online
    - sludge storage tank mixing online

Recent Improvements

- Primary “Egg-Shaped” Digester Mixer Replacement

Recent Improvements

- Gravity Belt Thickener Polymer Activation System
- Dewatering Polymer Activation System

Recent Improvements

- Sludge Storage Tanks Large Bubble Mixing System

Recent Improvements

- Sludge Truck Bay Extension with New Conveyors and Automated Controls

THANK YOU!

- City of Nashua, NH
  - Lisa Fauteux – Public Works Director
  - Steve Dookran, PE – City Engineer
  - Bill Keating, PE – Wastewater City Engineer
  - Dave Simmons – WWTF Superintendent
  - John Adie – WWTF Operations Manager
  - WWTF Operation / Maintenance Staff
- T-Buck Construction
  - Bruce Kenney – Project Superintendent
- Electrical Installation, Inc.
  - Chuck Fritz – Project Electrical Contractor

Questions

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